

# Reliable sensors for rail vehicles

Safety, punctuality and comfort are important requirements that rail transport must meet, today and in the future. Baumer has been active in this field for many years as a reliable partner in rail transport technology. Durable, cost-effective standard sensors in robust housings with proven sealing designs, sensor technology matched to the specific application and industry-standard qualification are as much part of the wide ranging product portfolio as customer-oriented new developments for every conceivable sensor application in rail transport technology.

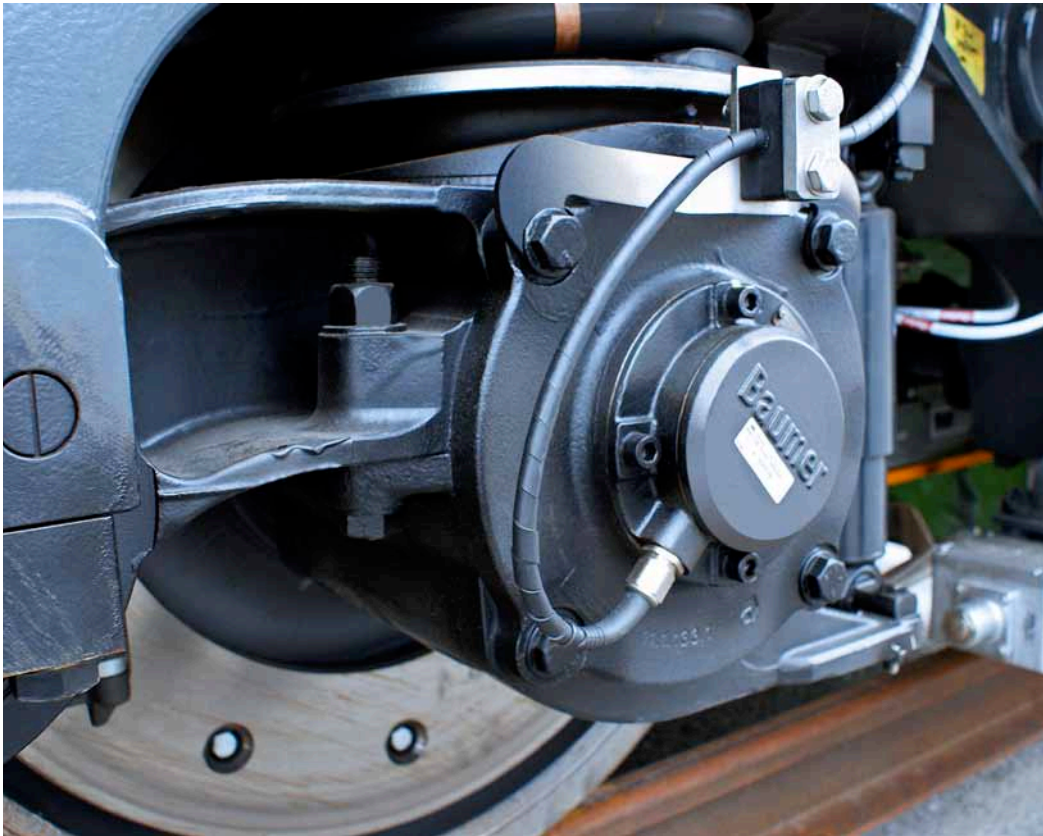


Safety, speed and comfort are important requirements that rail transport must meet, both today and in the future. Therefore various sensor technologies are necessary to fulfill these demands.

## Sensor technology for drive system and undercarriage

Slide control, slip regulation and train control systems such as the European train control system (ETCS) contribute significantly to safety in rail transport nowadays. To this end, angle and rpm

must be recorded at many relevant points in the drive system and undercarriage bogie. The multiple channel encoder BMIV, developed especially for hard use in bogies, offers excellent performance characteristics. Up to 12 channels in galvanically insulated blocks allow simultaneous



BMIV multiple channel encoder for slip prevention, traction control and train control systems.

wheel set speed information in multiple systems, even with differing pulse rates. Function control signals ensure maximum safety. The sensor transmits signals even when the train is halted. These "signs of life" ensure that a cable break, for example, is detected as quickly as possible.

#### Scanning principles for tough ambient conditions

The proven *MAGRES* principle offers excellent performance characteristics under these tough operating conditions. In contrast to all other sensing principles, this magnetic scan is completely impervious to stresses found in rail transport such as vibration, shock, dirt, oils, grease, spray water, condensation, wide temperature swings or external magnetic fields. The impulse generators meet railroad standards and, with the SIL 2 expert assessment, are also suitable for the European train control system (ETCS).

*HDmag* series encoders also operate with magnetic sensing. The magnetic hollow shaft encoders with an inside diameter of up to 740 mm can be installed directly on the engine hub. Thanks to their axially very slim design and elimination of a torque pin, they require very little space on the shaft. Signal processing integrated into the sensing head permits selection of square wave (HTL or

TTL) or sin/cos signals. The electronics assembly of the sensor head is fully encapsulated to protect it from soiling, shocks and vibrations.

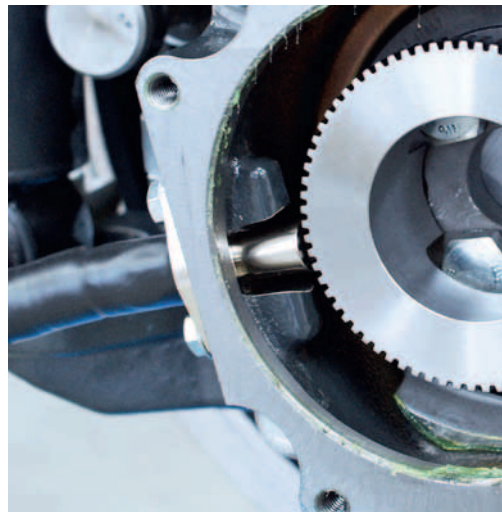
Sensors that scan ferromagnetic toothed wheels using the Hall principle are equally suitable for use in rail vehicles. The tasks of the contactless MTRM 16 Hall sensor include, for example, speed acquisition for slide control, speed regulation and determination of rotation direction. Depending on model, it is suitable for toothed wheel sizes up to module 3 and can be used at temperatures from -40 to



The magnetic hollow shaft encoders *HDmag* with an inside diameter of up to 740 mm can be installed directly on the engine hub.

+120°C. Furthermore, the sensor is shock and vibration resistant and completely enclosed in a rugged metal housing. Thanks to switching frequencies up to 20 kHz, the MTRM 16 can also reliably determine the speed of rapidly rotating toothed wheels.

The FOG 9 incremental encoder, which has already proven its reliability on the most powerful four-axle diesel-hydraulic locomotive in the world, provides a further example of safety-related sensor technology on rail vehicles. The 2,700 kW Vossloh MaK 2000-4 BB is even capable of starting up on a 2.8% grade pulling a 745 ton train. Optimized slip protection that recognizes slippage at the limit of wheel traction makes a contribution to this performance. The needed speed acquisition is handled by the heavy duty incremental encoder, which is installed directly on the unsprung axle with its B10 euro flange. The short design and massive aluminum housing, with bearings at both ends of the stainless steel shaft, provide great oscillation and shock resistance. High voltage power transistors and assured that the square wave signals are transmitted without interference, even over longer distances.



Non-contact speed regulation of gear wheels with an MTRM 16 Hall sensor.

### Safety and comfort – pressure measurement in railroad applications

Pressure measurement is an important area of application for sensors in railroad technology. The spectrum extends from the brake system to pantographs, the motive power unit cooling system and all the way to shock absorbers or air conditioning. The pressure measurement devices must be extremely robust due to unavoidable shocks during the journey. That's why the PBSD pressure



Baumer supports the railway industry with a broad portfolio of sensors.



transmitter was developed for extreme stresses. It monitors the pressure in the brake system of various high-speed trains and is suitable for pneumatic and hydraulic brake control as well as for cooling circuits. Robust EF6 pressure transmitters also come into play in the high-voltage field for monitoring pantograph pressure.

The MEX3 pressure measurement device is suitable for heavy duty applications in rail vehicles, such as the monitoring of hydraulic pressure in train parking brakes. This stainless steel measuring device is encased in an aluminum housing with a polycarbonate viewing window especially for use under these particularly tough ambient conditions.

The CPX/PFX pressure switch is frequently used in the cooling systems of power generators, air conditioning equipment or brake systems on, for example, streetcars. It was developed for a temperature range of -40 to +150°C and is readily adapted to individual needs.

**Safety and comfort at steps, doors and windows**  
Inductive and capacitive sensors also have many areas of application in rail vehicles. For example, a minimum gap is required between the platform edge and the car for comfortable, safe boarding. The correct outrigger limit position of the boarding aid can be monitored by inductive sensors. These durable, reliable sensors are also suitable for monitoring closure of doors and windows. They are available in the cylindrical and rectangular designs and are suitable for sensing distances up to 20 mm, depending on version. Like all the other sensors, they are exhaustively tested and designed for years of reliable operation.